



Inside the overstimulated, underregulated, multinational **CAFFEINE** industry.

## THE PRODUCTS

Here are just a fraction of the quick fixes on the market today.



## The History

Highlights of our 5,000-year addiction to caffeine

2737 BC

Chinese emperor Shen Nung is said to discover tea when leaves blow into his cup of hot water.

AD 350

The first account of planting and drinking tea is published in China.

ca. 1000

Coffee, previously eaten as beans, is first infused with water.

1300s

The process of roasting coffee is discovered.

1511

Mecca's governor bans coffee, citing ill health effects and bad behavior in those who drink it.

**CAFFEINE HAS GONE CRAZY.** It now comes in so many forms that it's hard to keep up: soft drinks, obviously, but also energy drinks, energy shots, chewing gum, sports gels, and nasal sprays. In all of them, the marquee ingredient is a white powder, delivered to our bloodstreams by a sophisticated global supply chain that few of us know anything about. ●●● The scale of this industry is as eye-opening as a NoDoz. Americans plow through more than 15 million pounds of powdered caffeine annually—enough to fill a freight train 2 miles long, all 270 cars loaded to the brim. ●●● This turbocharging might be taking a toll on our health. US emergency room visits related to energy drinks spiked from 1,100 in 2005 to 13,000 in 2009, and in November the FDA announced it was investigating 5-Hour Energy after 13 deaths were associated with the popular product. Through it all, sales continue to jitter upward. We have become creatures that turn caffeine into motion, and the corner store is our filling station. Here's a graphical look at the drug that keeps America moving.

BY MURRAY CARPENTER ●●● ILLUSTRATIONS BY CARL DETORRES



1615

Venetian merchants introduce coffee to Europe.

1734

J. S. Bach composes the "Coffee Cantata."

1819

Friedlieb Ferdinand Runge, a German chemist, isolates caffeine from coffee.

1886

Coca-Cola is introduced.

1895

Emil Fischer, another German chemist, synthesizes caffeine from urea.

1898

Pepsi-Cola is introduced.

## Synthetic Caffeine

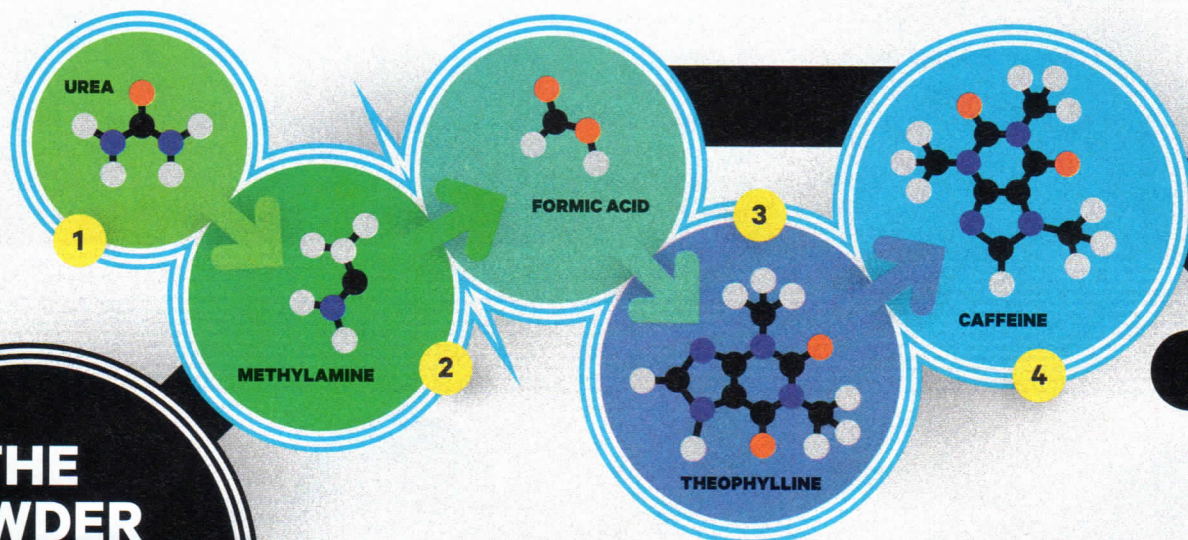
These days, the majority of caffeine is made in chemical factories—and most of that happens in China. According to Panjiva, which tracks global trade, just three Chinese firms manufacture nearly half of the caffeine consumed in the US. Different factories make caffeine in slightly different ways, but here's how German firm BASF does it.

**1)** The essential building block of caffeine is urea, a nitrogen-rich compound produced from ammonia. (Walk by a synthetic-caffeine factory and you'll often catch that distinctive cat-pee smell.)

**2)** The urea is transformed with agents like methylamine (whose role in making crystal meth you might remember from *Breaking Bad*) and formic acid (which ants emit when threatened).

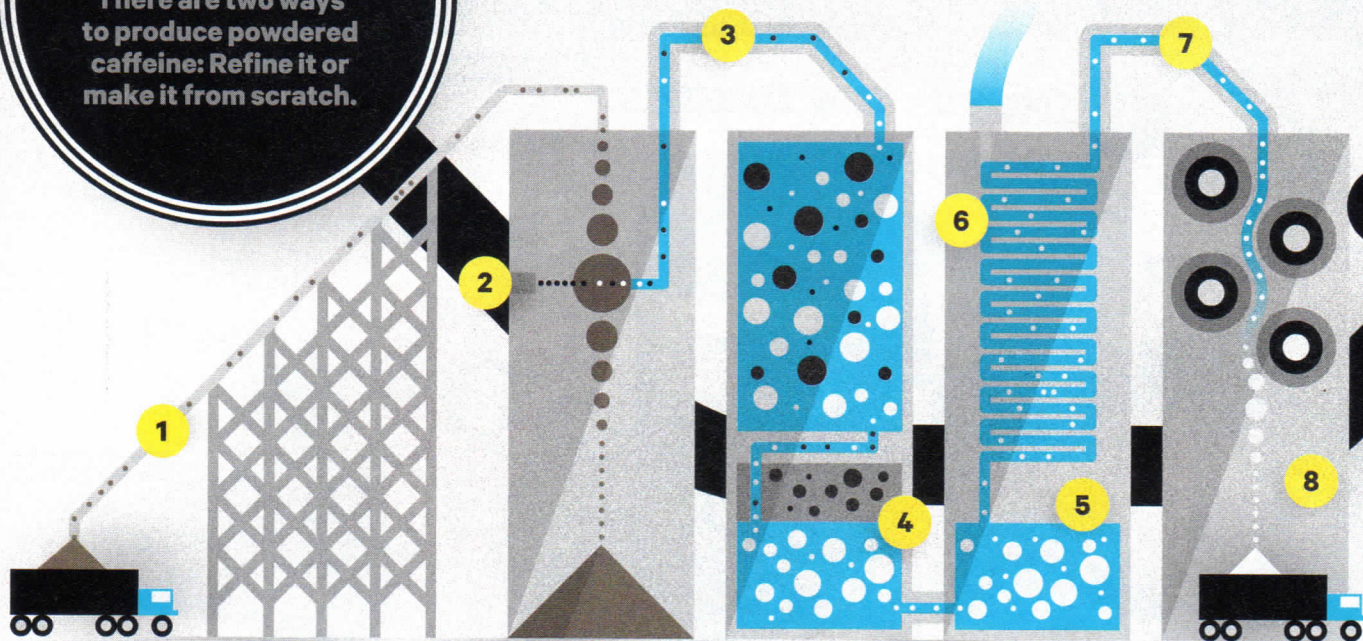
**3)** Eventually it becomes theophylline, a stimulant with properties much like caffeine's. If not for our long history with caffeine, we might be drinking theophylline sodas today.

**4)** The theophylline is mixed with methyl chloride, which "methylates" it. Voilà—pure synthetic caffeine. "It's classic organic chemical synthesis," says MIT researcher Stephen Sofen. "Nothing fancy."



## THE POWDER

There are two ways to produce powdered caffeine: Refine it or make it from scratch.



## Natural Caffeine

America's largest natural caffeine producer is Maximus Coffee Group, which extracts it from more than 100 million pounds of beans per year. Here's how.

**1)** Beans are blown to the top of a 16-story tower. **2)** High-pressure carbon dioxide is pumped through them as they fall—stripping away caffeine while leaving the coffee flavor intact.

**3)** The caffeine-laden carbon dioxide is blended into water. **4)** That solution is pumped into another chamber, where the pressure drops, separating the caffeine and water from the CO<sub>2</sub>.

**5)** The caffeinated liquid—roughly 0.2 percent caffeine—is stored in tanks. **6)** It then flows through concentrators, where steam coils evaporate it into a syrupy

caffeine concentrate. **7)** Finally, the concentrate is poured over hot rotating drums to dry. **8)** What's left is a flaky tan powder: natural caffeine, roughly 95 percent pure.

1909

Federal government seizes shipment of Coca-Cola over the alleged ill effects of caffeine.

1911

Coke hires psychologist Harry Hollingworth, who demonstrates the benefits of caffeine.

1938

Nescafé instant coffee is launched.

1980

Journalists at the 1980 Democratic National Convention are offered emergency NoDoz kits.

1985

Jolt Cola is introduced.

1992

Starbucks goes public.

## BRAIN

Caffeine acts by blocking the neurotransmitter adenosine, which tells us when we're tired. It binds to the receptors that adenosine normally occupies—in essence,

hogging the bar stool so adenosine is unable to sit down. Besides imparting a feeling of energy and alertness,

## EYES

A study of Navy SEAL trainees found that 200 to 300 mg of caffeine (four to six cans of Mountain Dew) yielded a measurable improvement in vigilance and visual reaction times.

# THE POWER-UP

Caffeine starts by crossing the blood-brain barrier—then it creates effects throughout the body.

## HANDS

A 1912 study of caffeine's effects reported that the drug increased the speed of a 38-year-old "lady typewriter." More recent research, however, has shown that it can actually impair fine motor performance—especially in infrequent users, who get the jitters.

## LEGS

Runners too seem to benefit from caffeine, with an increase in "time to exhaustion" (how long you can run without stopping). In general, optimal benefits for athletes tend to involve dosing of 3 to 6 mg per kilogram of body mass. To reach 6 mg/kg, a 175-pound athlete would need 480 mg of caffeine, or six cans of Red Bull.

## ARMS

A 2010 study found that caffeine increased upper-body strength in female gym-goers. It also seems to provide a small endurance boost: In a study of competitive rowers, average times in a 2,000-meter race dropped by more than 1 percent.

## THE PROBLEM

Caffeine is addictive; also, since it's a diuretic, it can cause dehydration. But worst of all, in rare cases an overdose of caffeine can kill you, typically by stopping your heart. The FDA hasn't released much data about the 13 deaths it's investigating, but in at least three cases the official cause of death was heart attack. Usually it takes a lot of caffeine to get there. In April 2010, a Briton named Michael Bedford ate two spoonfuls of pure caffeine powder and washed it down with an energy drink. He quickly vomited, collapsed, and died. But Bedford likely consumed more than 5 grams of caffeine—the equivalent of 24 shots of 5-Hour Energy. That's more than even the biggest buzz-chaser would ever want to swallow.

**MURRAY CARPENTER** ([murraycarpenter.com](http://murraycarpenter.com)) is writing a book about caffeine, *All Jacked Up*, to be published next year by Hudson Street Press.

1997

Red Bull is launched in the US.

2003

Stay Alert gum is introduced.

2004

5-Hour Energy creates the first "energy shot."

2009

Scientists and state attorneys general petition the FDA to restrict alcoholic energy drinks.

2011

LeBron James introduces Sheets, melt-on-the-tongue caffeine strips.

2012

The FDA investigates claims of 13 deaths related to 5-Hour Energy; results are still pending.